Remarks

In view of the foregoing amendments and following remarks, reevaluation and further processing of the application is requested. Prior to amendment herewith, Claims 19-26 were pending in the application. By amendment herewith, Claim 19 has been amended, Claims 23-24 have been canceled, and new Claims 30-39 have been added. Claims 19-22, 25-26 and 30-39 are now pending in the application.

A. Rejection Under § 112

The Examiner rejected Claim 23 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Applicant has cancelled Claim 23 without disclaimer to subject matter contained therein.

B. Rejections under § 102

I. U.S. Patent No. 3,960,678

The Examiner has rejected Claims 19-24 and 26 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 3,960,678 to Alder ("Alder"). The Examiner states that Alder discloses stable anodes for aluminum electrolysis cells that contain oxides, and that Alder discloses the use of Fe_2O_3 and Fe_3O_4. The Examiner further states that, although Alder discloses that SnO_2 was the preferred base oxide, it is clear from Col. 3, lines 45-47 that Alder contemplated making the electrodes with either Fe_2O_3 or Fe_3O_4 as the base material of the anode.

Claim 19 has been amended to recite that the stable anode comprises a monolithic body containing at least 80 wt % iron oxides. Applicant respectfully submits that, although Alder does disclose that Fe_2O_3 or Fe_3O_4 could be the base material, one of ordinary skill in the art would read the base material limitation of Alder as utilizing up to 20 wt % Fe_2O_3 or Fe_3O_4.

As noted by the Examiner, Alder relates to anodes of SnO_2 having additives, such as Fe_2O_3 or Fe_3O_4. For example, at Col. 3, lines 51-56, Alder states:

> "On the other hand, without additives, SnO_2 can not be made into a densely sintered product and it exhibits a relatively high specific resistivity at 1000°C. Additions of other oxides in a concentration of 0.01-20 %,

> preferably 0.05-2 % have to be made in order to improve such properties of pure tin oxide."

Alder only discloses the use of up to 20 wt % Fe_2O_3 or Fe_3O_4 in conjunction with the use of tin oxide (Col. 3, lines 51-61). All of the Examples of Alder disclose anodes including only up to 10 wt % iron oxides (e.g., Tables I, Table II, IV, and VII). Thus, Alder only discloses anodes with up to 20 wt % iron oxide. Read in conjunction with the fact that Alder uses the word "base material" only twice, once in Col. 3, as mentioned by the Examiner, and a second time in Example 1, where Alder notes that his base material is tin oxide, Applicant respectfully submits that one of ordinary skill in the art would read Alder as a whole as disclosing anodes having a base material of Fe_2O_3 or Fe_3O_4 as having only up to 20 wt % Fe_2O_3 or Fe_3O_4.

In view of the foregoing, Applicant respectfully submits that Alder does not disclose stable anodes having a monolithic body containing at least 80 wt % iron oxides as provided in Claim 19. At best, Alder discloses anodes including up to 20 wt % Fe_2O_3 or Fe_3O_4. Thus, Applicant respectfully submits that Claim 19 is novel and non-obvious over Alder.

Applicant also draws the Examiner's attention to new Claims 30 and 31. New Claim 30, which is dependent off Claim 21, which is dependent off Independent Claim 19, recites that the monolithic body is entirely composed of Fe_3O_4 and FeO. Nowhere does Alder disclose, teach or suggest a monolithic anode body that is entirely composed of Fe_3O_4 and FeO. Indeed, Alder does not disclose the use of FeO at all. New Claim 31, which is dependent off Claim 22, which is dependent off Independent Claim 19, recites that the monolithic body is entirely composed of Fe_2O_3 and FeO. Nowhere does Alder disclose, teach or suggest a monolithic anode body consisting essentially of Fe_2O_3 and FeO. Indeed, Alder does not disclose the use of FeO at all. Support for new claims 30 and 31 may be found at, for example, paragraph [0013] of the application. Hence, Applicant respectfully submits that new Claims 30 and 31 are novel and non-obvious over Alder.

Applicant also draws the Examiner's attention to new Claims 33 and 35, which provide that the stable anode comprises an additive, wherein the additive is an oxide of one of Al, Si, and Mg. Support for new claims 33 and 35 may be found at, for example, paragraph [0014] of the application. Nowhere does Alder disclose the use of additives of those oxides.

Hence, Applicant respectfully submits that new Claims 33 and 35 are also novel and non-obvious over Alder.

Applicant further draws the Examiner's attention to new Claim 38, which provides for an electrolytic aluminum production cell including the stable anodes of Claim 19, where the aluminum electrolysis cell is operable at temperatures of from about 850°C to about 920°C to produce commercial purity aluminum. Support for Claim 38 may be found at, for example, paragraph [0019]. Nowhere does Alder disclose, teach or suggest that his anodes could be utilized at temperatures of 850°C to 920°C to produce commercial purity aluminum. Alder only discloses that his anodes are utilized at temperatures above 960°C (*see* Col. 7, lines 66-68 and Tables II, IV, VI, and VII). Alder also does not suggest that his anodes could be utilized at lower temperatures to produce commercial purity aluminum. Hence, Applicant respectfully submits that new Claim 38 is also novel and non-obvious over Alder.

II. U.S. Patent No. 6,372,099 to Duruz

The Examiner rejected Claims 19, 20, 22, 23, 25 and 26 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 6,372,099 to Duruz et al. ("Duruz"). The Examiner states that Duruz discloses stable anodes for aluminum electrolysis cells that contain oxide coatings, and expressly discloses Fe_2O_3 (hematite). The Examiner further states that the anode of Duruz was formed from a metallic body having an iron oxide coating.

As noted above, Claim 19 has been amended to recite that the stable anode comprises a monolithic body containing at least 80 wt % iron oxides. Nowhere does Duruz disclose, teach or suggest a monolithic anode body of at least 80 wt % iron oxides. Indeed, as recognized by the Examiner, Duruz only discloses an anode having a metal-based substrate:

> "The invention provides a cell for the electrowinning of aluminium by the electrolysis of alumina dissolved in a molten fluoride-containing electrolyte. The cell comprises one or more anodes, each having a metal-based substrate and an electrochemically-active iron oxide-based outside layer . . In the context of this invention: a metal-based anode means that the anode contains at least one metal in the anode substrate as such or as an alloy, intermetallic and/or cermet." (Col. 3, lines 51-67).

Hence, Duruz does not disclose a monolithic anode body of at least 80 wt % iron oxides, and therefore Applicant respectfully submits that Claim 19 is novel and non-obvious over Duruz.

III. U.S. Patent No. 4,411,761 to Roos

The Examiner rejected Claims 19-21 and 24-26 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 4,411,761 to Roos et al. ("Roos"). The Examiner states that Roos discloses stable anodes that contain oxide coatings, and expressly discloses Fe_3O_4. The Examiner states that Roos discloses up to 70 wt % Fe_3O_4. The Examiner also states that since Roos teaches the same composition of the anode as claimed, one of ordinary skill in the art would have considered it to inherently possess the claimed stability in molten cryolite.

As noted above, Claim 19 has been amended to recite that the stable anodes are for electrolytic aluminum production cells and that the stable anodes comprise a monolithic body including at least 80 wt % iron oxides. Roos does not disclose a monolithic body including at least 80 wt % iron oxides. Indeed, Roos discloses that his iron oxides are generally used as the active layer of a based electrode, such as titanium (Col. 2., lines 23-27), and that the active layers are generally produced by spray coating (Col. 2, lines 37-51). Roos does disclose that the electrode could be entirely composed of the active layer (Col. 2, lines 27-29), but does not disclose how to make such an electrode. Thus, Roos does not disclose an anode comprising a monolithic body comprising at least 80 wt % iron oxides, as provided by Claim 19.

Furthermore, there are many differences between the electrolysis of aqueous solutions (e.g., the chloride solution of Roos) and electrolysis of a molten salt (e.g., cryolite for an aluminum production cell), such as temperature differential, solubility issues and corrosion issues. Indeed, electrodes used for aqueous electrolysis are generally quite different than those used for molten salt baths due to the vast temperature, corrosion and solubility differences between the two. For example, electrolysis of aqueous chloride solutions generally occurs at temperatures less than 100°C, while electrolysis of molten salt baths generally occurs at temperatures in excess of 700°C. In this case, one of ordinary skill in the art would not consider the electrodes of Roos suitable for use in a molten salt bath since, for example, Roos spray coats his anodes and provides no teaching as to how factors such as corrosion, diffusion, and stability of the anodes in a molten salt bath operating in excess of 700°C would be addressed. Most likely, Roos' anodes would not productively work in such a molten salt bath. Thus, one of ordinary skill in the art <u>would not</u> have considered the electrodes of Roos to be suitable for use in a molten salt bath, such as cryolite.

In view of the foregoing, Applicant respectfully submits that Claim 19 is novel and non-obvious over Roos.

IV. U.S. Patent No. 3,711,397 to Martinsons

The Examiner rejected Claims 19-21, 25 and 26 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 3,711,397 to Martinsons ("Martinsons"). The Examiner states that Martinsons discloses stable anodes that contain spinel coatings, and expressly discloses using magnetite (Fe_3O_4) as the spinel coating. The Examiner further states that it is considered that Martinsons teaches using an anode in a corrosive environment, such as molten cryolite.

As noted above, Claim 19 has been amended to recite that the stable anodes are for electrolytic aluminum production cells and that the stable anodes comprises a monolithic body including at least 80 wt % iron oxides. Like Roos, above, Martinsons discloses a spinel coating on a substrate for electrolysis of an aqueous metal chloride solution. Unlike Roos, Martinsons does not even suggest that his spinel coatings could make up the complete electrode. Thus, Martinsons does not disclose an anode comprising a monolith body containing at least 80 wt % iron oxides, as provided by Claim 19.

Moreover, Applicant respectfully submit that, although Martinsons does state that his anodes may be used with a metal salt (Col. 19, lines 47-51), Martinsons goes on to state that, in those cases, his electrodes are used to electrodeposit the metal on the cathode, and only notes metal salts of copper, nickel, iron and manganese:

> "[T]he electrolyte in the cell may be a salt of a metal which may be electrodeposited and this electrolyte electrolyzed between the spinel surface anode and a cathode to electrodeposit the metal on the cathode. Copper, nickel, iron, manganese, and the like may be so deposited in these salts." (Col. 19, lines 51-56).

Clearly, electrodeposition is different from traditional aluminum metal production. For example, electrodeposition generally is an aqueous-based process, as discussed above with Roos, whereas aluminum production utilizes a molten salt bath (e.g., cryolite). Martinsons provides no indication that his anodes could be utilized in a molten salt bath and does not disclose the use of his electrodes in aluminum production. Hence, for many of the same reasons provided above with respect to Roos, one of ordinary skill in the art would not considered the electrodes of Martinson to be suitable for use in a molten salt bath, such as

cryolite. In view of the foregoing, Applicant respectfully submits that Claim 19 is novel and non-obvious over Martinsons.

V. GB Patent Specification 1,433,805 to TDK Electronics

The Examiner rejected Claims 19, 20, 22-24 and 26 under 35 U.S.C. 102(b) as being anticipated by G.B. Patent No. 1,433,805 to TDK Electronics ("TDK"). The Examiner states that TDK disclose anodes having up to 95 mol % Fe_2O_3. The Examiner states that since TDK teaches the same composition of the anode as claimed, one of ordinary skill in the art would have considered it to inherently possess the claimed stability in molten cryolite at up to 960°C.

As noted above, Claim 19 has been amended to recite that the stable anodes are for electrolytic aluminum production cells and that the stable anodes comprises a monolithic body including at least 80 wt % iron oxides. Like Roos and Martinsons, above, TDK discloses a spinel coating on a substrate for electrolysis of an aqueous metal chloride solution. Unlike Roos, TDK does not even suggest that his spinel coatings could make up the complete anode. Thus, TDK does not disclose an anode comprising a monolith body containing at least 80 wt % iron oxides, as provided by Claim 19.

Moreover, for many of the same reasons discussed above with respect to Roos and Martinsons, one of ordinary skill in the art would not consider the electrodes of TDK to be suitable for use in a molten salt bath. As with Roos and Martinsons, TDK relates to electrodes suitable for the electrolysis of water or aqueous salt solutions (Abstract). Specifically, TDK notes that the anodes can also be used as anodes in electroplating, electro-dialysis or electrophoresis, and furthermore they can be used as anodes in the electrolytic anti-corrosion treatment of metals. Nowhere does TDK mention the use of anodes for aluminum metal production and TDK does not disclose, teach or suggest, that its electrodes could be used in a molten salt bath. Thus, for many of the same reasons discussed above with respect to Roos and Martinsons, one of ordinary skill in the art would not considered the electrodes of TDK to be suitable for use in a molten salt bath.

In view of the foregoing, Applicant respectfully submits that Claim 19 is novel and non-obvious over TDK.

New Claims Support and Fee Calculation

As noted above, Applicant has added new Claims 30-39. Support for new Claims 30-31 may be found at, for example, paragraph [0013]. Support for new Claims 32-35 may be found at, for example, paragraphs [0013-0014]. Support for new Claim 36 may be found at, for example, paragraph [0010]. Support for new Claims 37 and 39 may be found at, for example, paragraph [0012]. Support for new Claim 38 may be found at, for example, paragraph [0019]. Any necessary additional claim fees are calculated below.

For	Claims Remaining After Amendment	Highest Number Previously Paid For		Extra Claims	Rate		Additional Fee
Total Claims	16	- 20	=	0	x $50	=	$0
Independent Claims	3	- 3	=	0	x $200	=	$0
Multiple Dep. Claim	0	- 0	$360			=	$0
Total Fee						=	$0

Conclusion

In light of the above amendments and remarks, it is believed that the present application is now in condition for allowance, and such action is respectfully requested. If the Examiner believes that it would be helpful to discuss any of the amendments or remarks presented herein, the Examiner is invited to contact the undersigned at the telephone number provided.

Respectfully submitted,

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